

Measles Outbreak at Western High

Read the following story about some students at Western High:

It began with Naoko Yomata. She and her family had just moved when she started the second half of her junior year at Western High in a small town in Washington State. One week into the semester, she had a sore throat, felt exhausted, and developed a fever of 102°F. Soon, she had a red rash all over her body—measles.

Ten days later, Caleb Miller and Jessica Johnson came down with measles. These students were in Naoko's biology class, and Jessica was her lab partner. The following week, a sophomore, Michael Chen, had measles and so did the students' biology teacher, Ms. Baker.

The local public health officer was alarmed. Western High hadn't had a case of measles in 10 years, and now there were *five* cases in less than a month.

A Little Sleuthing

Read the rest of the story about the measles outbreak at Western High and think about the question that ends it.

A little sleuthing revealed the following:

Naoko had just arrived in the United States from her home country, Japan, where she apparently contracted measles. She had not been vaccinated as a child. Caleb was also susceptible to measles because his parents had objected to vaccinations. Jessica and Michael were vaccinated when they were 15 and 18 months old, respectively, but they had missed the required “booster shot” during elementary school.

Ms. Baker was vaccinated in 1966 when she was 5 years old. Later studies showed that the initial “killed measles” vaccine was not very effective compared with the currently used “live measles” vaccine, first available in 1968. Ms. Baker was unaware that her vaccination was not effective or that she needed a booster shot.

The results of the public health officer’s detective work explained why Naoko, Caleb, Jessica, Michael, and Ms. Baker got the measles. But there is another question:

In the 1950s and 1960s (before the measles vaccine was developed), most people got this disease as preschool children or as elementary school students. Why didn’t the unvaccinated or inadequately vaccinated students and teacher at Western High get measles when they were children, rather than now, as teenagers or adults?

Following an Epidemic

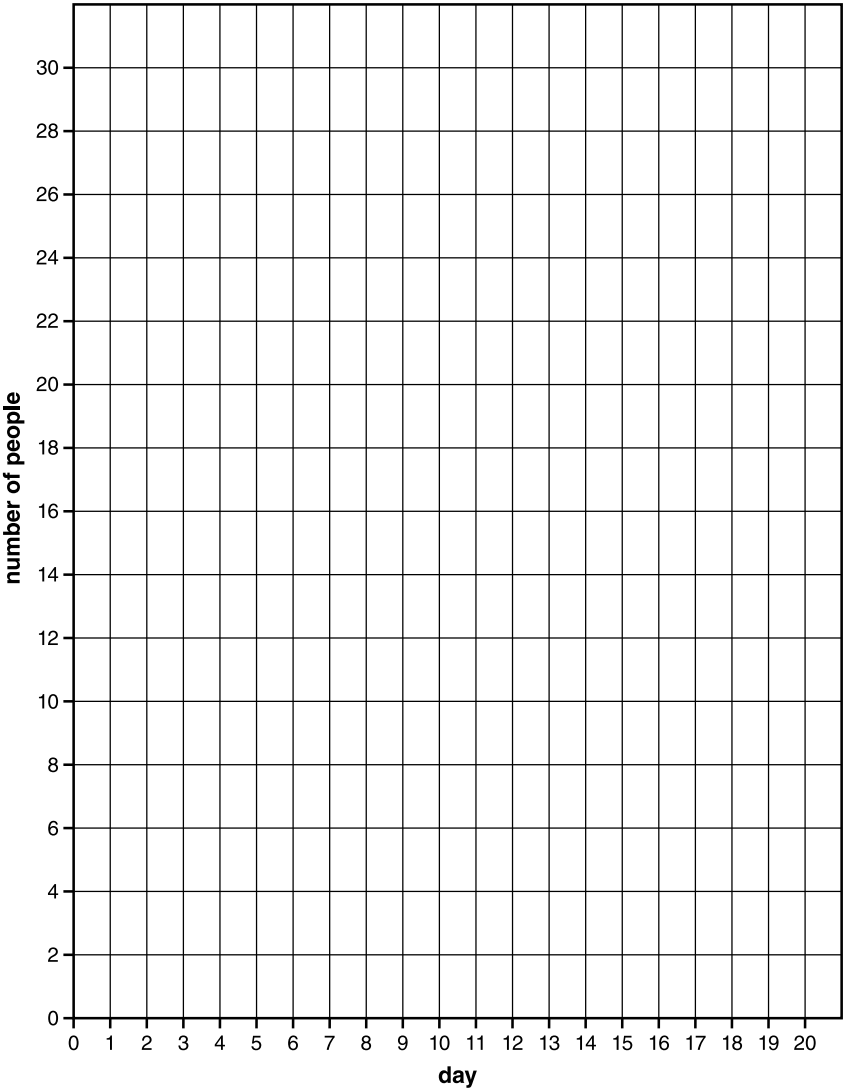
This worksheet will help you track the results of the disease transmission simulation. Follow your teacher’s instructions for completing the following tables and graphs.

Observations

Review your data on the table and graph, then make three or four observations about the transmission of two-day disease. For example, did an epidemic occur in both simulations? How long did it last? Did everyone get sick at some point?

Day	Number of People Sick	Number of People Immune
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Time Course of an Epidemic



Total number of illnesses _____

Disease Transmission Simulation Record

Use the computer simulation of disease transmission to investigate the effect of changing a disease characteristic on the occurrence of an epidemic.

1. Run the computer simulation of disease transmission first with the Disease Characteristics values set for two-day disease: virulence = 0; duration of infection = 2; rate of transmission = 1; initial percent immune = 0. Record the results below.

Did an epidemic occur? Y N

Maximum number of sick _____

Maximum percentage sick _____

Maximum occurred on day _____

2. Circle the disease characteristic you were assigned to investigate:

virulence duration of infection rate of transmission immunity level

3. Test four settings for that characteristic across the range that the simulation allows. Keep the settings for the other disease characteristics the same as for two-day disease. Record the results below.

Simulation 1

Characteristic tested set at _____

Did an epidemic occur? Y N

Maximum number sick _____

Maximum percent sick _____

Maximum occurred on day _____

Simulation 2

Characteristic tested set at _____

Did an epidemic occur? Y N

Maximum number sick _____

Maximum percent sick _____

Maximum occurred on day _____

Simulation 3

Characteristic tested set at _____

Did an epidemic occur? Y N

Maximum number sick _____

Maximum percent sick _____

Maximum occurred on day _____

Simulation 4

Characteristic tested set at _____

Did an epidemic occur? Y N

Maximum number sick _____

Maximum percent sick _____

Maximum occurred on day _____

Summary

Write a one- to two-sentence summary that describes how the likelihood of an epidemic changes as your disease characteristic changes.

Characteristics of Smallpox, Polio, and Measles

Disease	Virulence	Duration of Infection	Rate of Transmission	Immunization Level for Herd Immunity
smallpox	high (0.25)	14 days	high (2.5)	
polio	low (0.01)	18 days	average (1)	
measles	low (0.01)	8 days	very high (10)	

Cases of Smallpox in Niger and Bangladesh

Country	Year	Population	Percent of People Vaccinated	Number of Smallpox Cases	Cases of Smallpox per Square Kilometer
Bangladesh	1973	72 million	80	33,000	0.23
Niger	1969	3.9 million	79	25	0.00002

Source: Anderson, R.M., & May, R.M. 1992. *Infectious diseases of humans*. New York: Oxford University Press, p. 89.